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**United States Patent** [19]

Gilbert et al.

[11] **Patent Number:** **5,983,230**[45] **Date of Patent:** **Nov. 9, 1999**[54] **ORDERED SPARSE ACCUMULATOR AND ITS USE IN EFFICIENT SPARSE MATRIX COMPUTATION**[75] **Inventors:** John R. Gilbert, Palo Alto, Calif.; William W. Pugh, Jr, Silver Spring; Tatiana Shpelsman, Adelphi, both of Md.[73] **Assignee:** Xerox Corporation, Stamford, Conn.[21] **Appl. No.:** 08/573,708[22] **Filed:** Dec. 18, 1995[51] **Int. Cl.<sup>6</sup>** ..... G06F 17/00[52] **U.S. Cl.** ..... 707/101; 395/707; 395/708;

364/736.03

[58] **Field of Search** ..... 395/601-602, 395/607-612, 621-622, 570-708; 364/800.11-800.16, 725.01-754.02; 707/1-206[56] **References Cited****U.S. PATENT DOCUMENTS**

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[57]

**ABSTRACT**

A data structure, called an ordered sparse accumulator (Ordered SPA), permits sequencing in numeric order by index and dynamic alteration of the nonzero structure of the active column in sparse matrix computations during the sequencing operation.

**5 Claims, 5 Drawing Sheets**